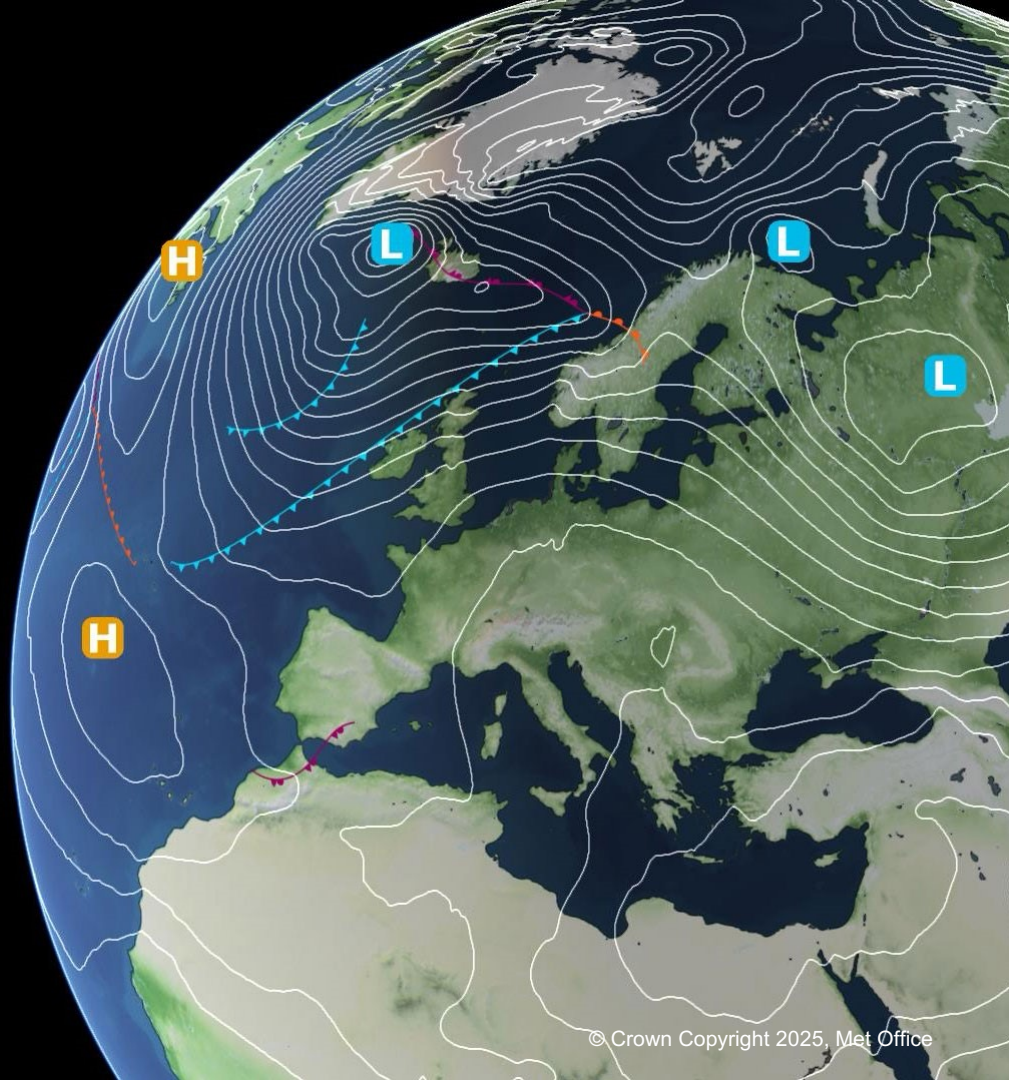
Met Office Update

WGNE40

Tim Graham



Met Office

Contents

- Timeline of planned upgrades
- Highlights from PS47
  - Global
  - Regional
- Further ahead:
  - Status of GC6 (the first LFRic based global model)

Forecast system updates

New HPC Operational

PS48:
- Retire deterministic models
- 10km global ensemble
- 1.5km regional ensemble
- Rapid cycling (3hr) global

Gen2 HPC

PS47:
- GC5 global model
- RAL3 regional
- JOPA obs operator (Global)
- MET verification

PS49:
- LFRic dynamical core operational in Global model (GC6)
- Global JADA

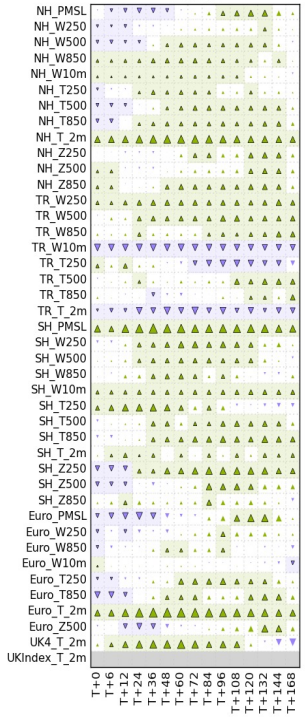
Global Model

- NEMO 4.0.4 & SI3 (replacing CICE)
- Convection improvements
  - Including “Fountain Buster”
- Bi-modal cloud initialisation
- Improved stability due to blended orography (ensemble timestep increased from 5mins to 7.5mins)
- JOPA obs operator
- Tuning of SPT and Bias correction improves CRPS (RMSE and spread).

Met Office Global summary (MOGREPS-G)

Winter

vs Obs



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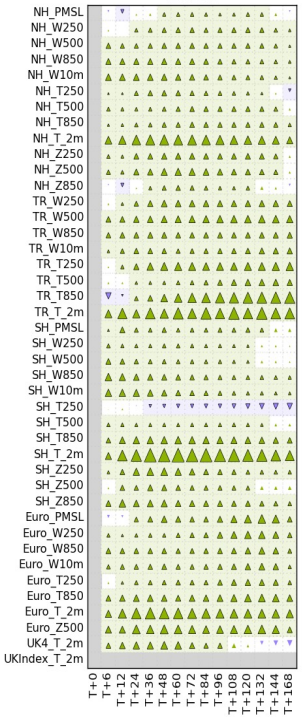
vs MOanalyses



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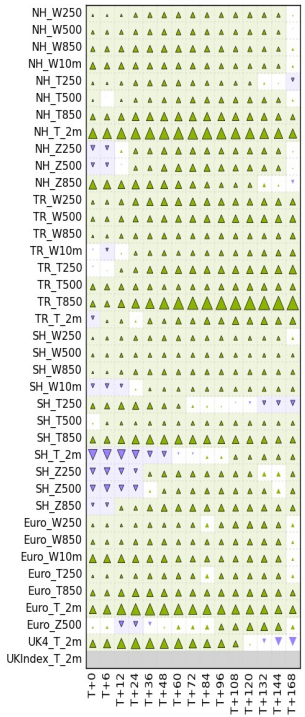
vs ECanalyses



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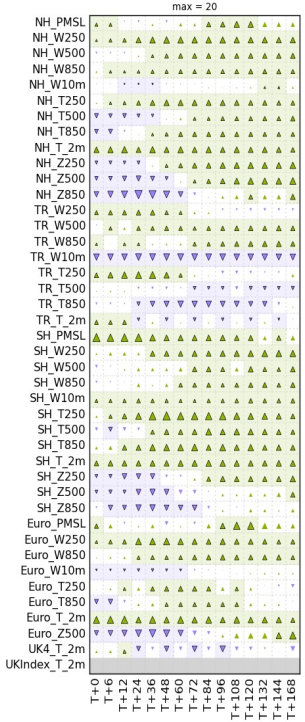
Summer

vs Obs



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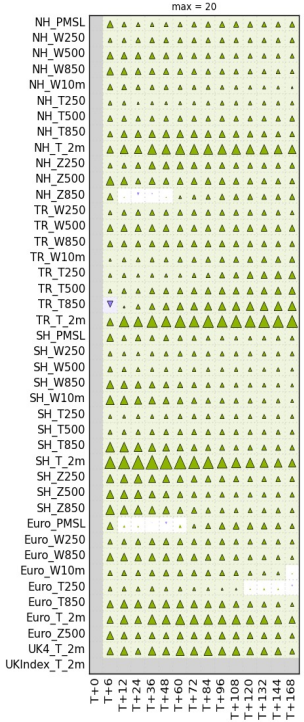
vs MOanalyses



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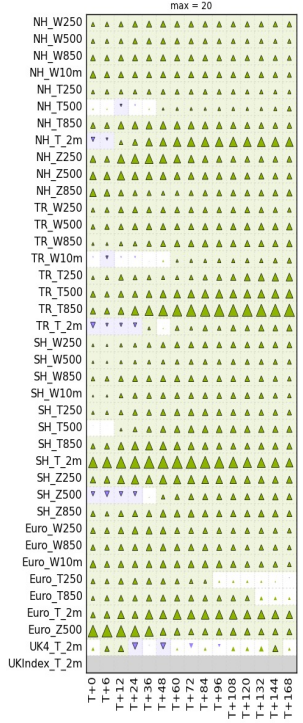
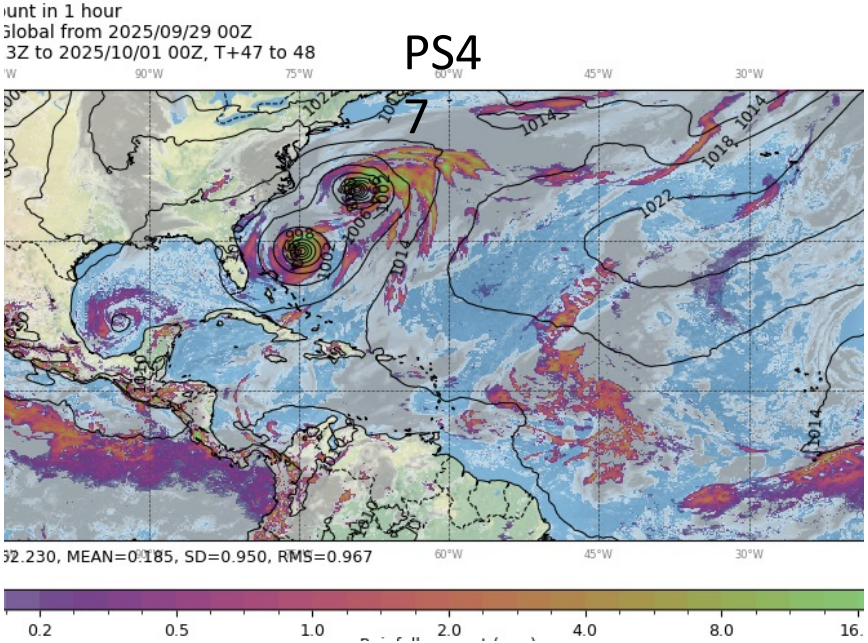
vs ECanalyses



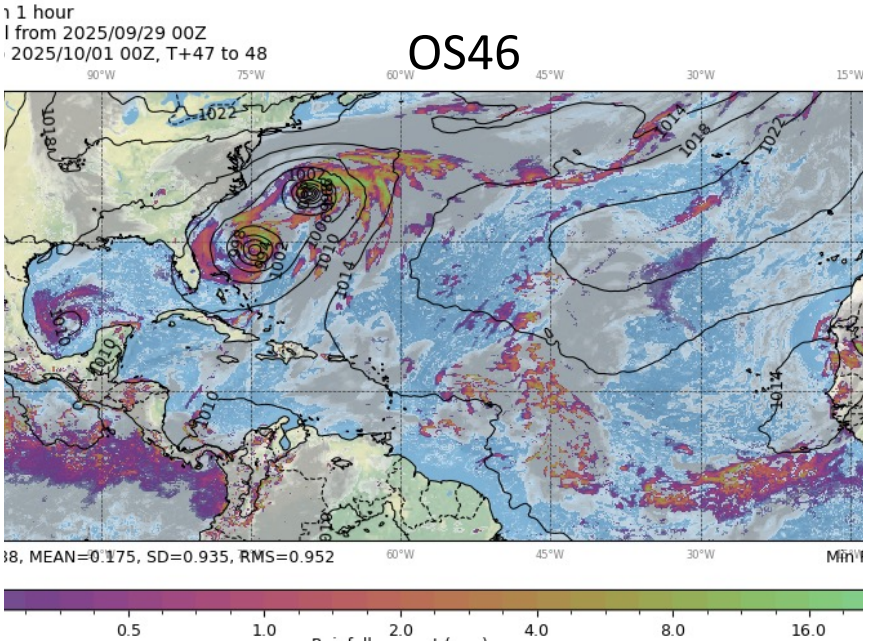
+2.9%

Forecasts of Hurricane Humberto & Imelda

PS4



OS46

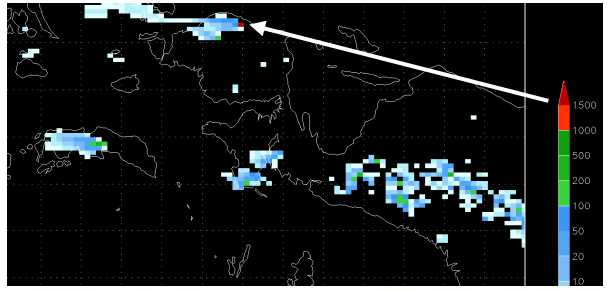


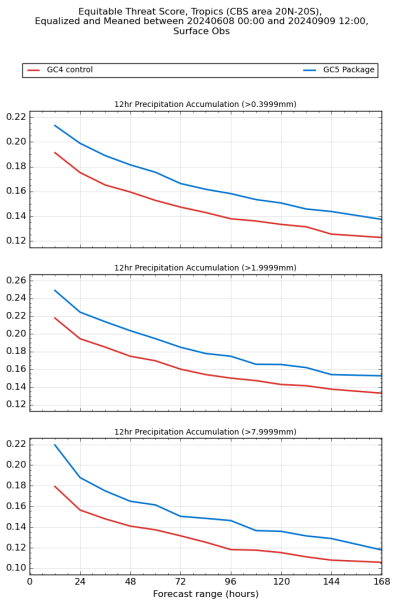
GC5 Precipitation

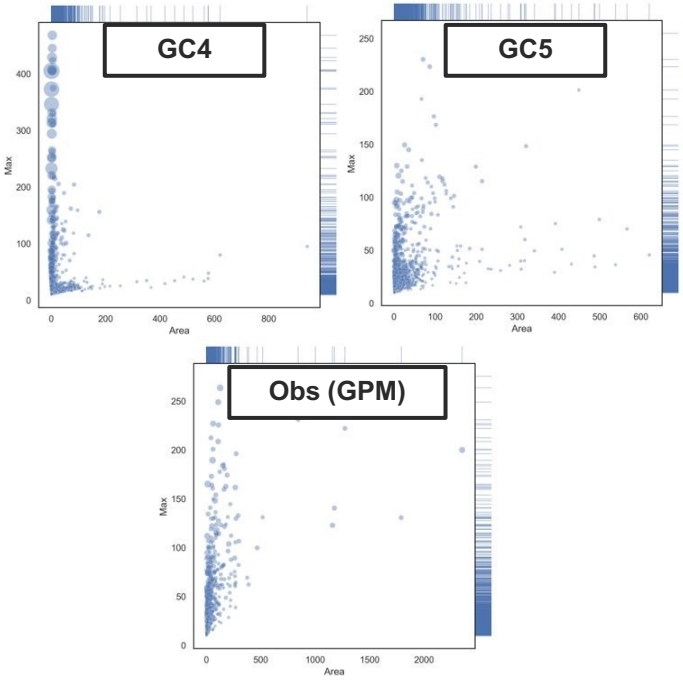
high-res trial July-Oct 2022

- Precipitation ETS improved in GC5 at all thresholds
- Fountain-buster scheme has eliminated unrealistic heavy spot values of precipitation
- Convection is more organised (next slide)

GC4: 1500mm from large-scale precip in 12 hours!

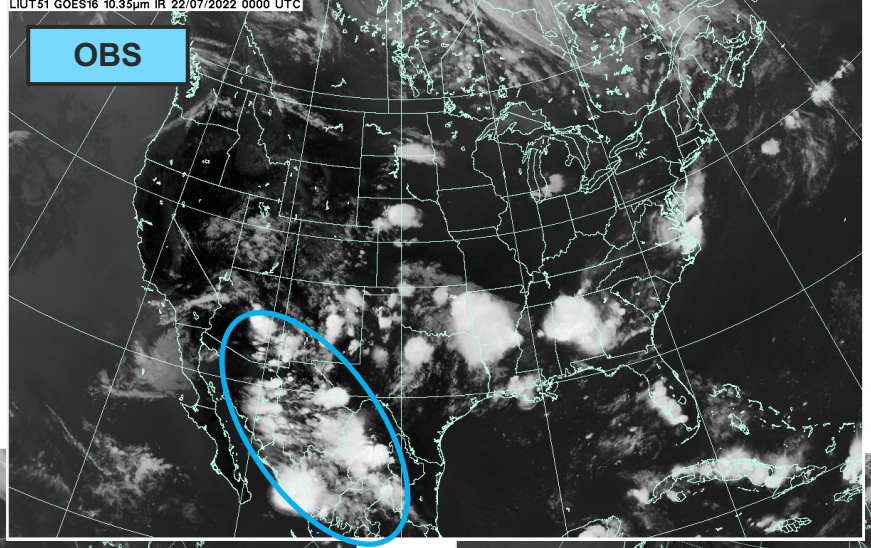


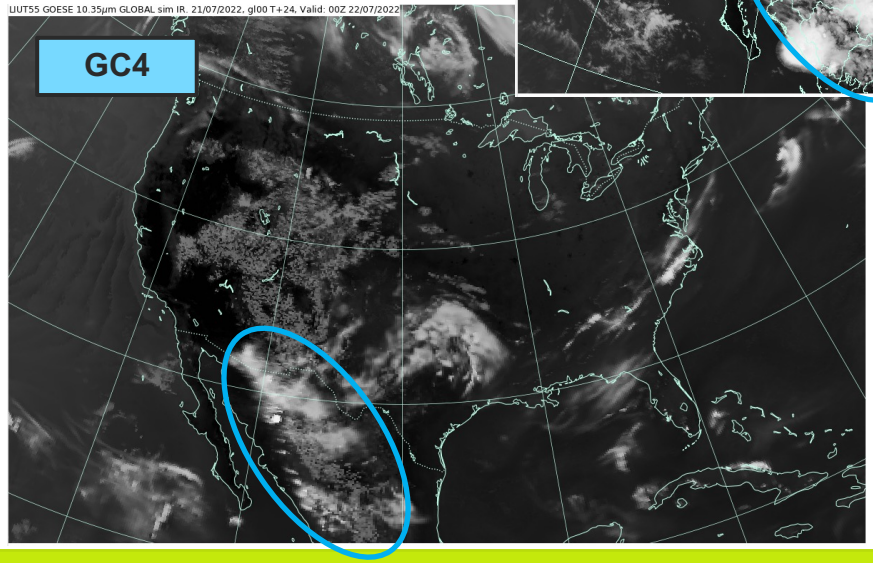


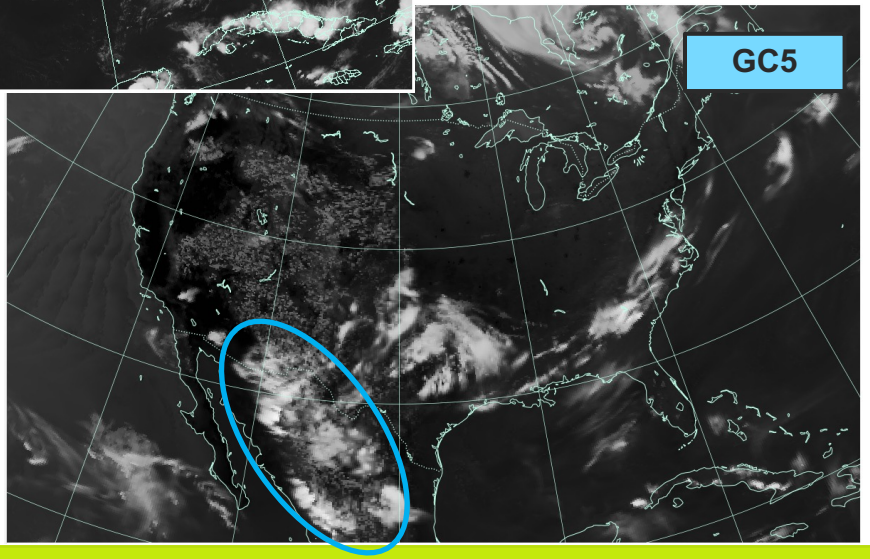


Simulated satellite imagery

GC5 has deeper and more organised deep convection







RAL3 details

- Bi-modal cloud scheme *(Kwinten van Weverberg)*

  Van Weverberg et al., 2021: https://doi.org/10.1175/MWR-D-20-0224.1 and https://doi.org/10.1175/MWR-D-20-0230.1

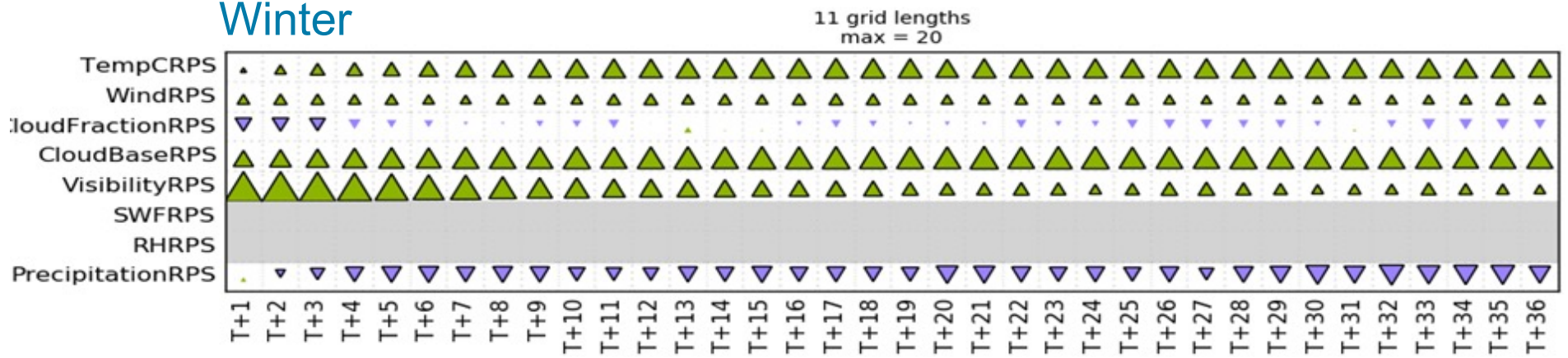
  - based on Smith cloud scheme previously used in mid-latitude RAL
  - replaces Smith scheme in RAL2-M and prognostic PC2 scheme in the tropical version RAL2-T
- CASIM multi-moment cloud microphysics scheme *(Adrian Hill, Paul Field, Kalli Furtado)*

  Shipway and Hill, 2012 - https://doi.org/10.5194/acp-18-14253-2018 , Miltenberger et all, 2018 - https://doi.org/10.5194/acp-18-3119-2018

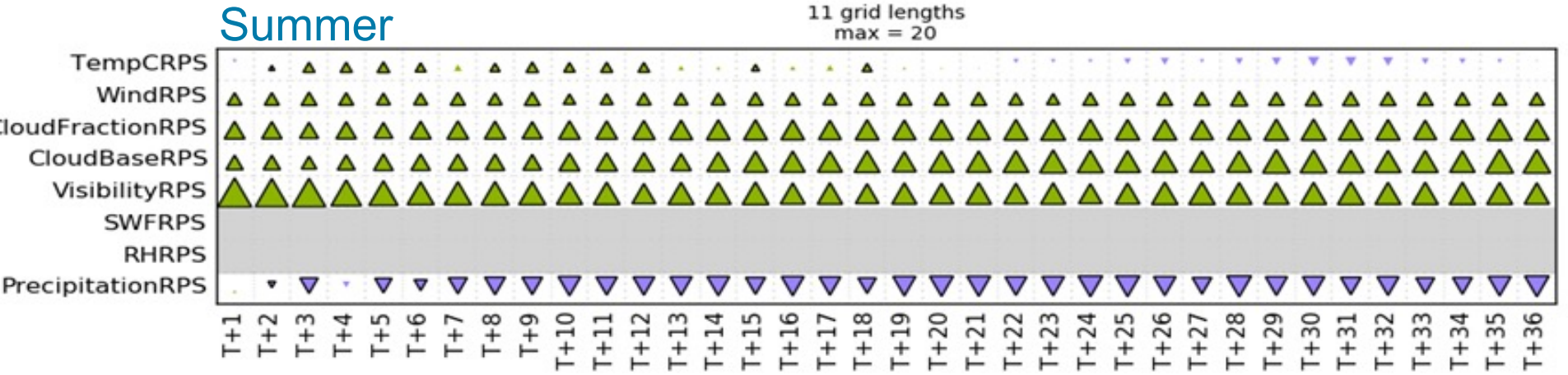
  - **C**loud **A**ero**S**ol **I**nteracting **M**icrophysics
  - permits the UM to have single or double moments microphysical capability
- stochastic boundary layer perturbations in mid-latitude configuration no longer needed *(Adrian Lock)*
- and many more…
- **No longer need different configurations for tropics and mid-latitudes!**

Met Office UK summary

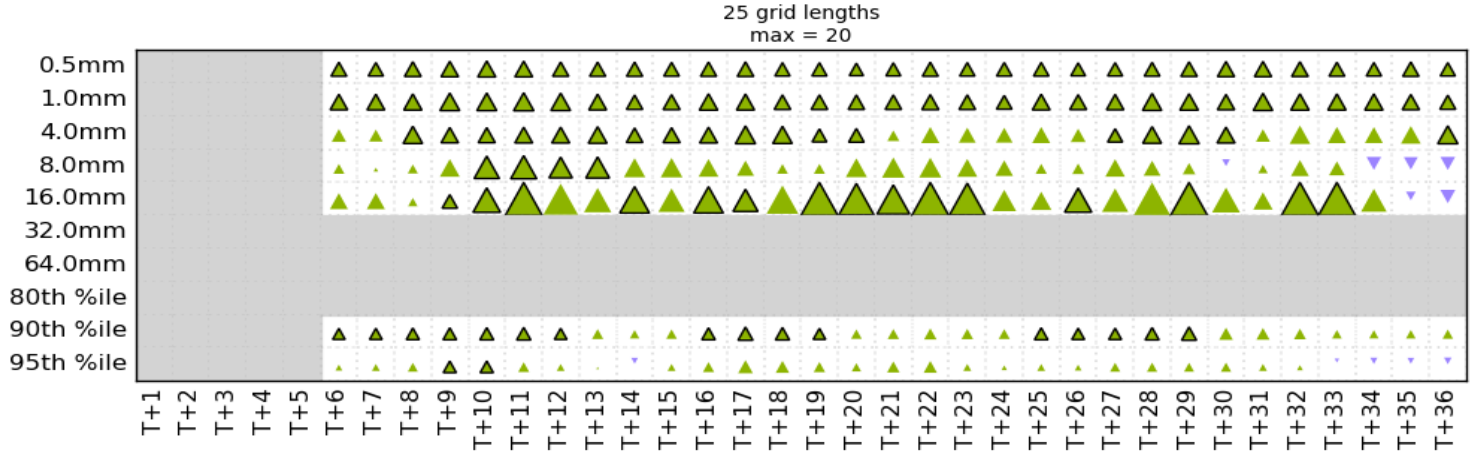
Winter



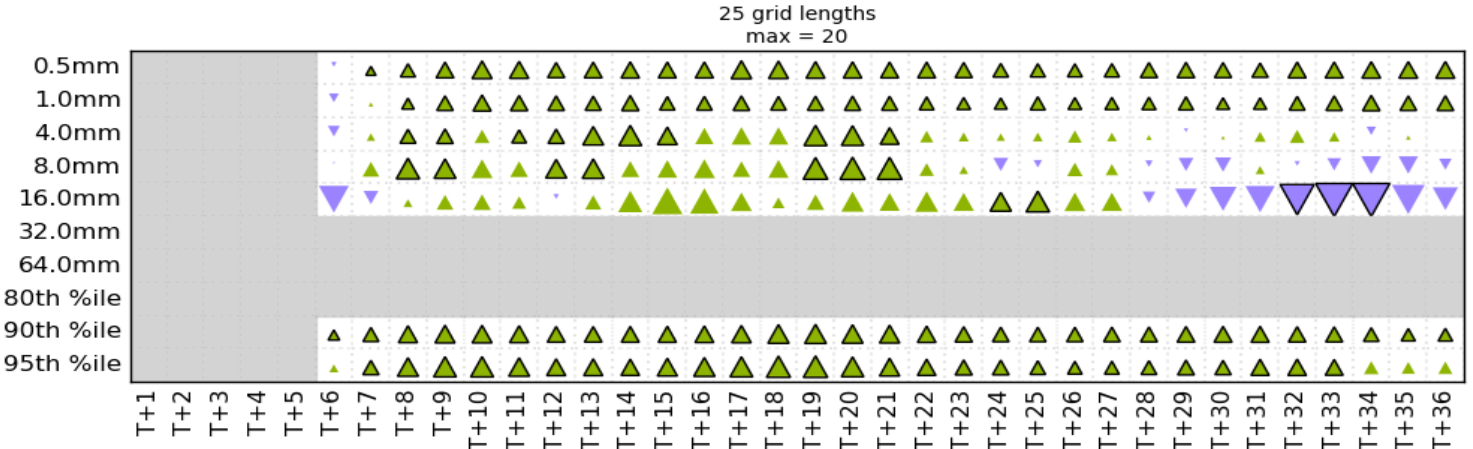
Summer



FSS precipitation scores



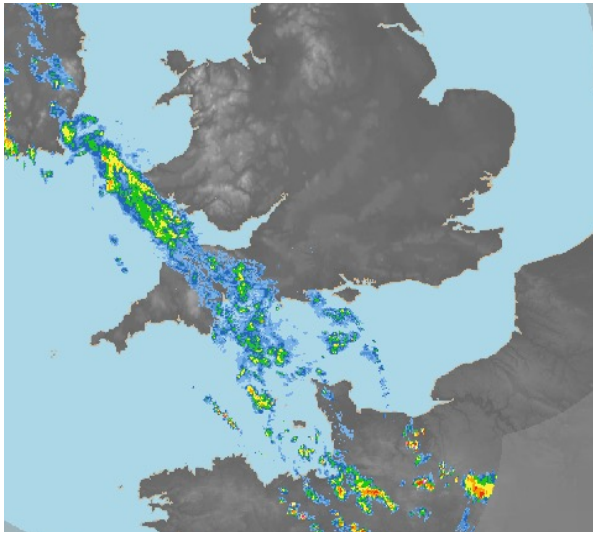
Winter



Summer

10th June 2023 (6 hr forecast)

Radar observation



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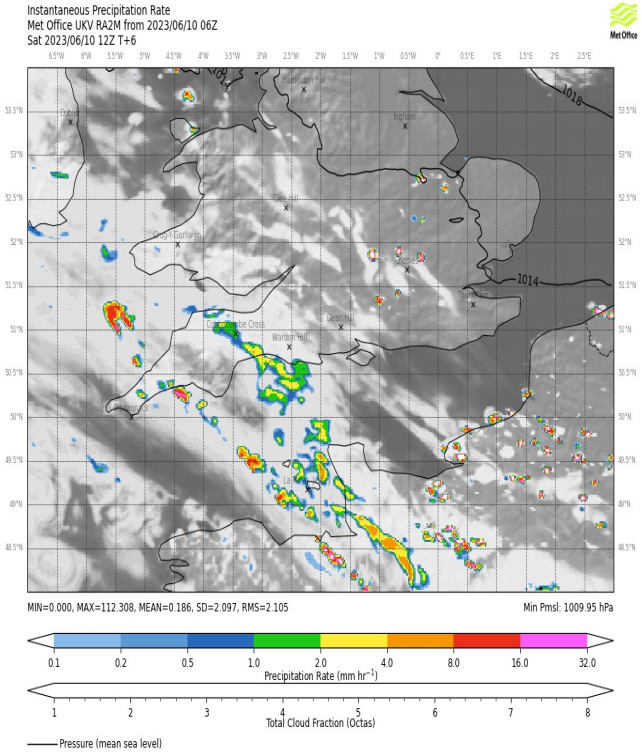
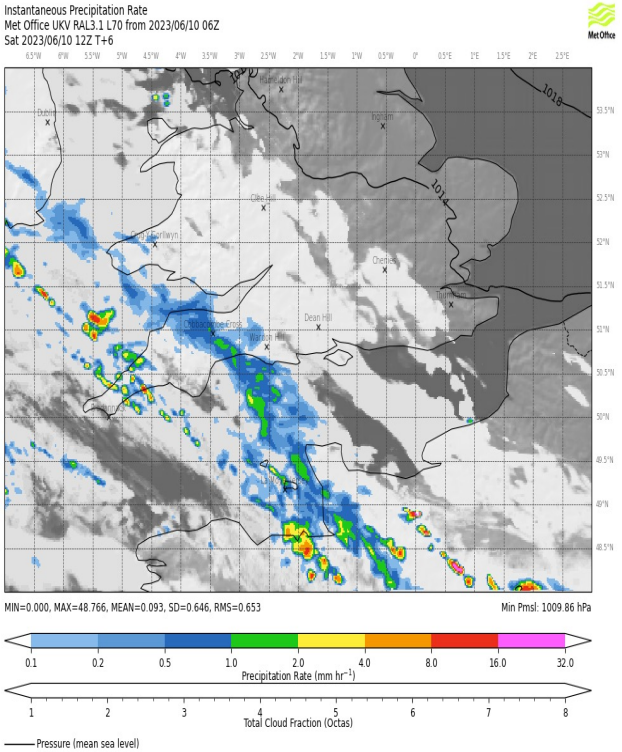


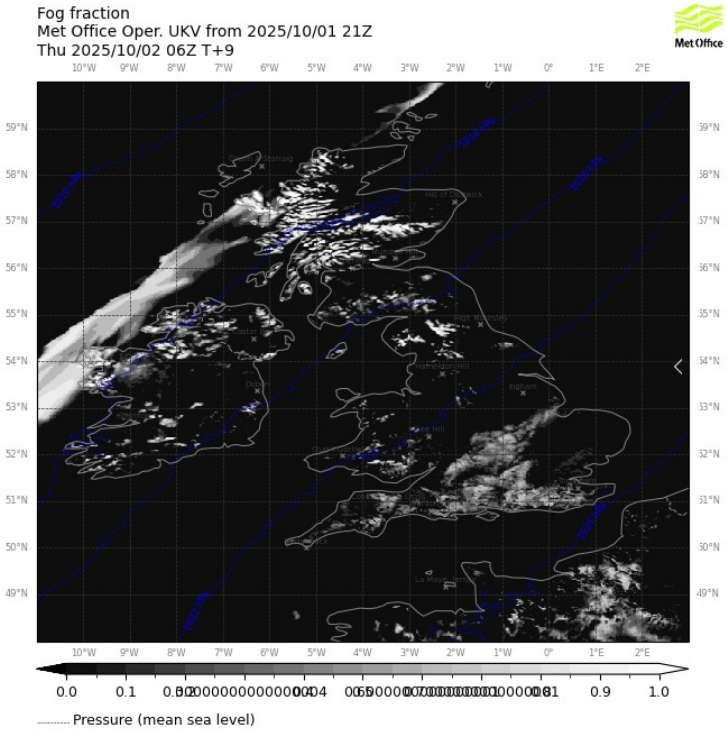
Front not coherent; rainfall too intense in patches

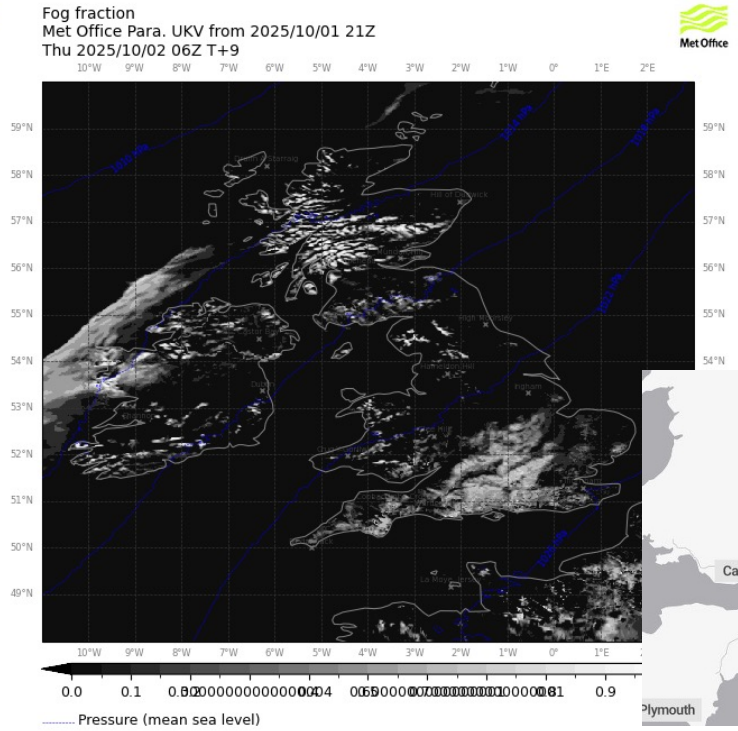
PS47

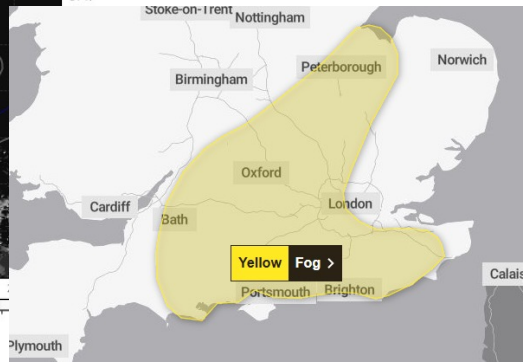


Spurious showers

Fog fraction case study







Met Office

Future Models

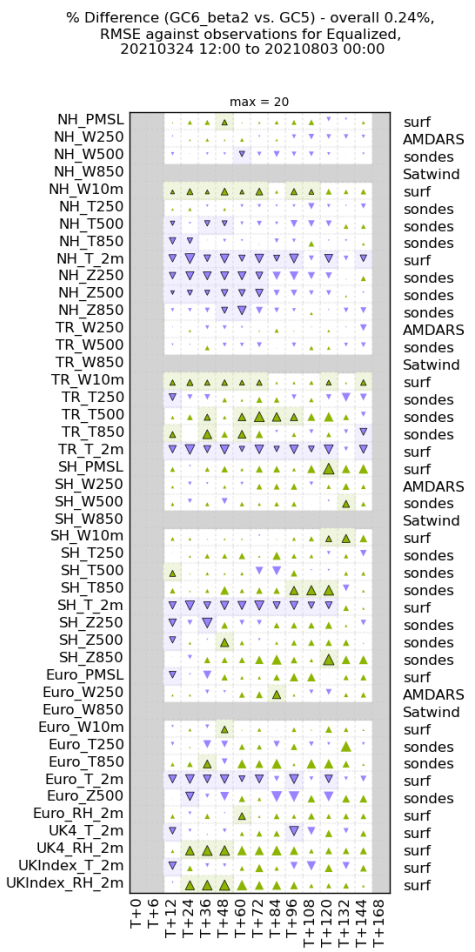
The first LFRic based coupled model – GC6

- Target to freeze model by February 2026
- Must match performance of GC5 in both scientific performance (NWP and climate) and model cost

NWP performance

- **Caution: Very small sample size**

- Small improvement in scores compared to GC5 (when compared to observations)



Summary

- First scientific update to operational suite since 2022 expected to go live in January (weather permitting)
  - Expect significant improvements to regional and global forecasts
  - Hope to see an improvement to tropical cyclone forecasts after the degradation seen in PS45
- Move to 10km global ensemble forecast around end 2026
- Making good progress with development of LFRic based coupled model for PS49